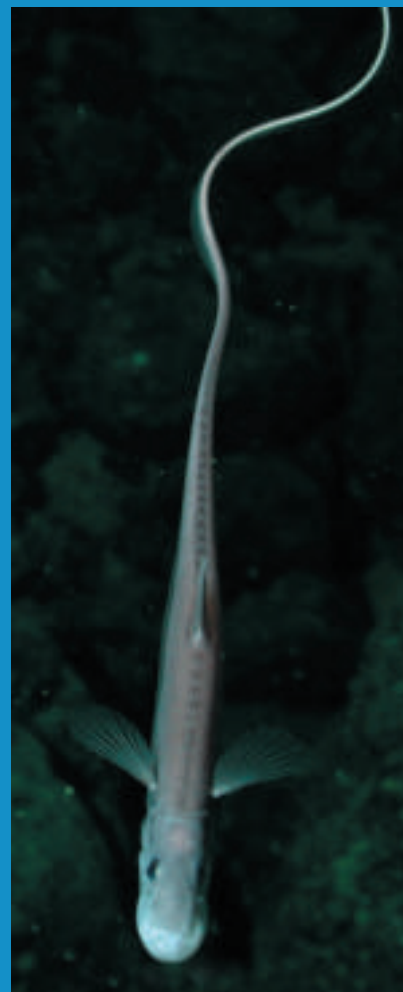


# ECOSYSTEM OBSERVATIONS

for the Monterey Bay National Marine Sanctuary  
2002



## The Groundfish Crisis: What Went Wrong?

The groundfish fishery off the U.S. West Coast is facing unprecedented restrictions as 2003 approaches. The Pacific Fishery Management Council (PFMC; [www.pcouncil.org/](http://www.pcouncil.org/)) has adopted a new management framework for controlling the harvest of overfished rockfish stocks within the Exclusive Economic Zone (EEZ). Under this new regulatory framework, large areas will be closed to groundfish fishing year-round. For example, south of Cape Mendocino a "Rockfish Conservation Area" has been established that strictly regulates fishing in ocean waters 120 to 900 feet deep, which essentially encompasses the entire continental shelf ecosystem off the coast of California. Within that depth zone, no fishing for rockfish or lingcod will be allowed. This new regulatory framework was implemented to reduce the bycatch of several overfished rockfish species, especially bocaccio (*Sebastes paucispinis*).

So how did we get into this dire situation? Have we been the victims of avaricious fishermen and laissez-faire managers? That seems to be the most frequent explanation, and it is they who have been most severely criticized in the media. However, there is much more to this story. In fact, for years there were serious flaws in the scientific advice that was presented to the council as the foundation of its decision making. The deficiencies were not easy to foresee and were due to a combination of inadequate data and fishery productivity that was far lower than anyone imagined. To understand how we got to this point, one must follow the history of groundfish management since the passing of the original Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) in 1976 to the present.

At the time the MSFCMA was passed, we knew little about the groundfish resources off the U.S. West Coast, particularly with respect to the potential sustainability of these fisheries. Even so, by 1982 the PFMC had developed a groundfish Fishery Management Plan (FMP) that required the determination of allowable biological catches (ABCs) for each actively managed stock. The ABC is a purely scientific determination that attempts to identify the annual catch of a stock if the fishery were managed to achieve the long-term maximum sustainable yield (MSY). However, facing a dearth of scientific information during the early 1980s, the PFMC adopted ABCs for many stocks that were based simply on the amount of historical catch, which capped groundfish harvests at their existing levels. At the time, this was viewed as a "first, do no harm" approach to management.

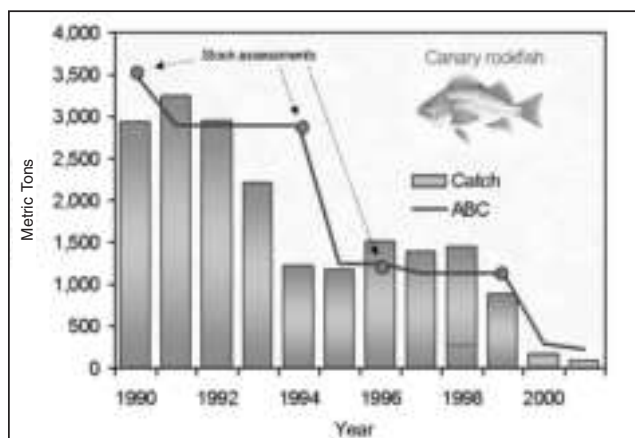


Figure 1. Relationship between the allowable biological catch (ABC) and the total catch of canary rockfish from 1990 through 2001. Points mark the completion of stock assessments, which resulted in a scientific change in the ABC.

As the information base increased markedly during the 1980s, individual "stock-assessments" began to be completed on the most important species in the fishery. A stock assessment is a scientific analysis that assembles all known sources of information about a species (e.g., landings, age- and length-frequency data, catch-per-unit-effort statistics, life history parameters) and funnels the information into a population model that statistically fits the data. The model is then used to answer questions concerning the status of the stock. Several things result from a stock assessment, including (1) an estimate of current stock size and (2) the historical time series of spawning stock size and recruitment, that is the new additions to the population. In theory, the latter information can be used to establish the innate productivity of a stock and MSY and the optimal rate of fishing (FMSY) can be determined. However, because of tremendous year-to-year variation in reproductive success, estimates of recruitment are inherently imprecise. This variability makes it nearly impossible to determine stock productivity parameters accurately.

Instead of relying on 'noisy' spawner-recruit information to set ABCs, the council adopted a harvest policy that still enjoys widespread use throughout the world today. That policy consists of

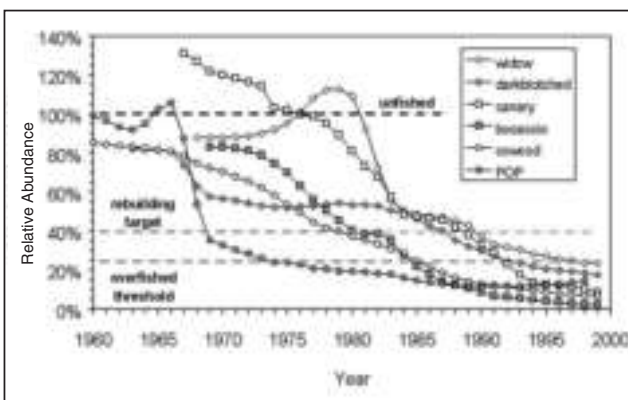


Figure 2. Relative population status of six overfished rockfish species. Populations that decline to below 25 percent of their unfished population level are declared overfished. Overfished stocks are considered rebuilt when they reach 40 percent of their unfished level.

applying a constant rate of fishing pressure to a stock, irrespective of population size; that is, a constant rate policy takes a fixed fraction (e.g., 10 percent) of the stock every year as harvest. Theoretical results show that such a policy has many desirable qualities, although  $F_{MSY}$  must first be determined, which unfortunately requires analysis of highly variable spawner-recruit data. However, theoretical results developed in the early 1990s by William Clark seemed to solve that problem. He showed that, over a broad range of productivity conditions, harvesting at the so-called  $F_{35\%}$  rate would be expected to produce no worse than 75 percent of MSY. ( $F_{35\%}$  is the rate of fishing that reduces the reproductive contribution of a new female recruit entering the exploited stock to 35 percent of what it would be if there were no fishing.) Best of all, that rate could be calculated from basic life history and fishery information; no spawner-recruit analysis was needed. Based on this scientific information, the council then adopted a groundfish harvest policy that applied the  $F_{35\%}$  rate to estimated stock size to yield the ABC. As a case in point, Figure 1 shows that the annual catch of canary rockfish was usually well within the ABC during the entire 1990s. The important conclusion here is that the PFMC adopted a scientifically based harvest

policy to set ABCs, and that harvest levels actually conformed to the policy for many years. In that regard, canary rockfish is by no means exceptional.

It wasn't until the MSFCMA was re-authorized in 1996 that the real difficulty was revealed. Language in the new Sustainable Fisheries Act required that all fishery management councils establish biomass-based targets and thresholds when setting ABCs. Whereas up until that point catches were determined solely by current stock size and the harvest rate proxy, now the councils had to consider the overall amount of stock depletion. To satisfy this new law, the PFMC adopted an amendment to the groundfish FMP that set a biomass target of 40 percent of the unfished level ( $B_0$ ) and an overfished threshold of 25 percent of  $B_0$ . The new law also required that if stock size were to fall below the overfished threshold, then a rebuilding plan had to be developed to return the stock to target level. However, as the council began applying its new biomass-based policies, it quickly became apparent that many rockfish stocks

were overfished, some severely so (*Figure 2, p. 19*). Bocaccio, for example, is currently estimated to be 4 percent of  $B_0$ .

So what went wrong? Results from a recent harvest policy workshop on West Coast groundfishes show clearly that over the past two decades these species have been amazingly unproductive stocks. The fallacy of applying Clark's  $F_{35\%}$  rate as a surrogate estimate for  $F_{MSY}$  is that under current conditions many of our stocks, especially the rockfishes, are barely able to replace themselves, even in the absence of a fishery. In essence, the PFMC used an established "rule of thumb" to set ABCs when they were dealing with stocks that were statistical outliers. Because the proxy harvest rate greatly overestimated  $F_{MSY}$ , the stocks continued to decline. Now, due to the need to rebuild and continued low productivity, it will take many years to rebuild overfished species to their target levels.

—STEVE RALSTON  
NATIONAL MARINE FISHERIES SERVICE

## Behind the Groundfish Closure

In the summer of 2002 the Pacific Fisheries Management Council (PFMC) closed waters outside of twenty fathoms to groundfishing, due to the depleted status of bocaccio, whose numbers have plunged by 96.4 percent since 1969. The council asserts that this action should save the fish commonly sold as Pacific red snapper from extinction and promote its eventual recovery. However, even under the new restrictions the slow-growing, slow-to-reproduce rockfish is not expected to recover for 170 years, according to the National Marine Fisheries Service (NMFS).

The Magnuson-Stevens Fishery Conservation and Management Act, passed in 1976, created a network of regional councils to manage the nation's fisheries in federal waters. The councils are required to manage these resources pursuant to management plans that are approved by NMFS. The Pacific Coast Groundfish Fishery Management Plan (FMP) was implemented in 1982. Previously management had been under the jurisdiction of the states of California, Oregon, and Washington. When the groundfish FMP was adopted, it established the authority and limitations on council actions, but was essentially a framework plan that did not contain specific regulations or management measures. It has been amended thirteen times in the last twenty years to respond to new statutory requirements and changing conditions in the fishery. Many argue that until now, the commercial fishery has been overexploited, despite a maze of regulation. In 1983 catch limits were first imposed, and over the past twenty years certain species have been the targets of specifically tailored efforts such as trip limits and regional management schemes. In 1994 the groundfish fishery was divided into open access and limited entry, with separate quotas and trip limits for each. The recreational fishery has traditionally been restricted with bag limits, but in 2000 recreational fishing was closed from March to June for all non-nearshore rockfishes.

The accompanying graph (*Figure 1*) depicts the catch of rocky deep shelf and slope rockfishes in the sanctuary over the past twenty years. The downward trend is likely due to a combination of decreasing abundance and increasingly restrictive regulations. Each "Q" on the graph represents the imposition of a quota for a species within the rocky deep shelf and slope groundfish complex. Common species within the sanctuary that have simultaneously exhibited the most significant declines in mean length over the past twenty years include chilipepper rockfish, bocaccio, yellowtail rockfish, and widow rockfish.

Bycatch is a particularly serious issue with which the council has had to contend. Mortality of deep-dwelling rockfishes is virtually guaranteed when they are brought to the surface. The council has

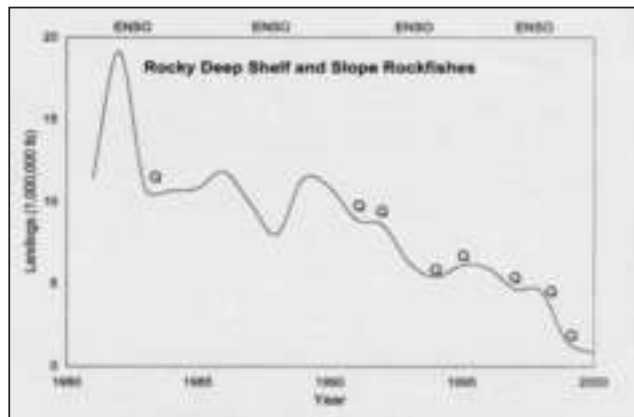
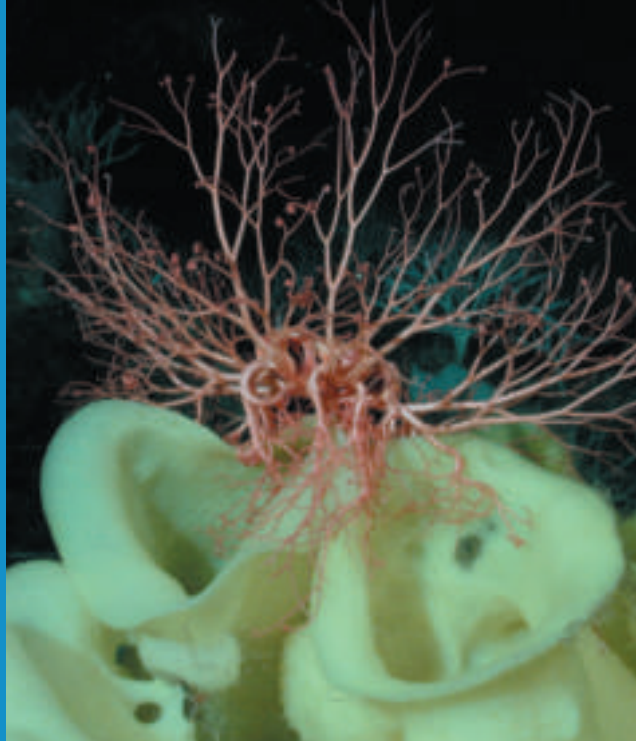


Figure 1: Reported commercial landings from 1981 through 2000 of rockfishes within the rocky deep shelf and slope habitats at the five major ports associated with the sanctuary. ENSO: El Niño Southern Oscillation (Source: Richard Starr, Jason Cope, and Lisa Kerr, *Trends in Fisheries and Fishery Resources*, a Sea Grant Publication, 2002.)

used estimates of rockfish bycatch of 15 to 30 percent of total catches for harvest modeling and management purposes. However, this range is a rough approximation and may represent a conservative estimate, particularly in bottom trawls. This has greatly complicated the effective establishment of harvest levels, which aim to restore what may be severely depleted stocks. Bycatch problems may also impact or even close other fisheries with high incidental catch rates such as the spot prawn fishery.

Local environmentalists believe that the groundfish collapse could have been avoided if the PFMC had heeded repeated warnings from marine scientists. They feel that the council has a pro-fishing bias and required absolute proof of a collapse before it was willing to restrict fishing, which has resulted in massive closures that will last decades with no guarantee that these fisheries will ever rebuild. Lawsuits filed by environmentalists such as the Natural Resources Defense Council may have been an additional catalyst for the closure. These alleged failures on the part of the council to adhere to statutorily required rebuilding plans designed to restore overfished stocks.

On the other hand, many central coast trawlers feel that the council is caving to pressure from environmental groups. The fishermen argue that the PFMC is required to base its decisions on data, and that the paucity of information available is an insufficient basis for such draconian measures. Many assert that there are more bocaccio in local waters now than at any time in the past ten years, and that the closure is a response to old, unreliable data.



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Front cover:

Top left: gorgonian, “bubblegum coral” (*Paragorgia spp.*) and purple polychaete worms (species unidentified); top right: sea cucumber (*Benthoodytes spp.*); bottom left: big red jelly (*Tiburonia granrojo*); bottom center: fly-trap anemone (*Hormathiidae*); bottom right: halosaur (*Aldrovandia spp.*).

Back cover:

Left: crab (*Neolithodes spp.*); center: basket star (*Gorgonocephalus eucnemis*) atop yellow sponges (species unidentified); right: tomopterid worm (species unidentified).

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Unless specifically stated, the views expressed in this issue do not necessarily reflect the opinions of the Monterey Bay National Marine Sanctuary, the National Marine Sanctuary Program, or NOAA.

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